

## Winter Storms

Classic blizzards such as the Blizzard of 1888, 1993 Storm of the Century, and the Blizzard of 1996 have their origins in the Gulf of Mexico, where the Gulf moisture is plentiful and the water temperatures are warm. During the winter months, the jet stream dips down from Canada and points northward. This usually creates a trough in the east. This trough causes the cold air to dip down, which in conjunction with the water vapor and energy from the south allows these systems to further develop into monster storms.

### *Heavy Snow*

Heavy snow, generally more than 8 inches of accumulation in less than 24 hours, can immobilize a community by bringing transportation to a halt. Until the snow can be removed, airports and roadways are impacted, even closed completely, stopping the flow of supplies and disrupting emergency and medical services.

Accumulations of snow can cause roofs to collapse and knock down trees and power lines. A quick thaw after a heavy snow can cause substantial flooding, especially along small streams and in urban areas. Costs associated with snow removal, repairing damages, and the loss of business can have severe economic impacts on cities and towns.

### Hazard Terminology

**Snow** – A steady fall of snow for several hours or more.

**Heavy Snow** – Snowfall accumulating to 6 inches or more in depth in 12 hours or less; or snowfall accumulating to 8 inches or more in depth in 24 hours or less

**Snow Squalls** – Periods of moderate to heavy snowfall, intense, but of limited duration, accompanied by strong, gusty surface winds and possibly lightning.

**Snow Shower** – A short duration of moderate snowfall.

**Snow Flurries** – An intermittent light snowfall of short duration with no measurable accumulation.

**Blowing Snow** – Wind-driven snow that reduces surface visibility.

**Drifting Snow** – An uneven distribution of snowfall and snow depth caused by strong surface winds.

**Blizzard** – The following conditions are expected to prevail for a period of 3 hours or longer:

- Sustained wind or frequent gusts to 35 miles per hour or greater
- Considerable falling and/or blowing snow, reducing visibility to less than 1/4 mile.

**Freezing Rain or Drizzle** – When rain or drizzle freezes on surfaces such as the ground, trees, power lines, motor vehicles, streets, highways, etc.

For the 1993 Storm of the Century, the National Weather Service's Office of Hydrology estimated the volume of water that fell as snow to be 44 million acre-feet. This is comparable to 40 days' flow on the Mississippi River at New Orleans.

Injuries and deaths related to heavy snow usually occur as a result of vehicle accidents. Casualties also occur due to overexertion by people shoveling snow and hypothermia caused by overexposure to the cold weather. Heavy snow can affect the entire state of West Virginia, but it is most common along the eastern mountain region.

It does not take several feet of snow to cause considerable risk to residents of West Virginia. On February 16, 1987, a mixture of rain, sleet, and snow contributed to more than 45 motor vehicle accident calls received by the Kanawha County 911 system in less than one hour. More than 200 accidents were reported throughout the county by mid-afternoon.

Following are the current snowfall records by period for West Virginia:

Table 6.1A: West Virginia Winter Weather Extremes

Snowfall – Greatest Amounts by Period			
Amount	Location	Period	Date
35 Inches	Flat Top	24 Hours	January 27-28, 1998
57 Inches	Pickens	Single Storm	November 24-29, 1950
104 Inches	Terra Alta	Month	January 1977
301.4 Inches	Kumbrabow State Forest	Year	Winter of 1959-60
62 Inches	Snowshoe	Uniform Depth	March 8, 1978

From National Weather Service Forecast Office, 2003

### ***Extreme Cold***

What is considered an excessively cold temperature depends on the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In West Virginia, extreme cold usually involves temperatures below zero degrees Fahrenheit. Excessive cold may accompany winter storms, may be left in their wake, or may occur without storm activity.

The greatest danger from extreme cold is to people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. The risk of hypothermia due to exposure greatly increases during episodes of extreme cold. Infants and elderly people are most susceptible. Certain medications, medical conditions, or the consumption of alcohol can also make people more susceptible to the cold. House fires and carbon monoxide poisoning are also possible as people use supplemental heating devices (wood, kerosene, etc., for heat and fuel-burning lanterns or candles for emergency lighting).

General observations by the National Oceanic and Atmospheric Administration (NOAA), indicated that in winter deaths related to exposure to cold: 50 percent were over 60 years old, more than 75 percent were male and about 20 percent occurred in the home. Of winter deaths related to ice and snow, about 70 percent occurred in automobiles, 25 percent of the people were caught out in the storm, and the majority were males over 40 years old.

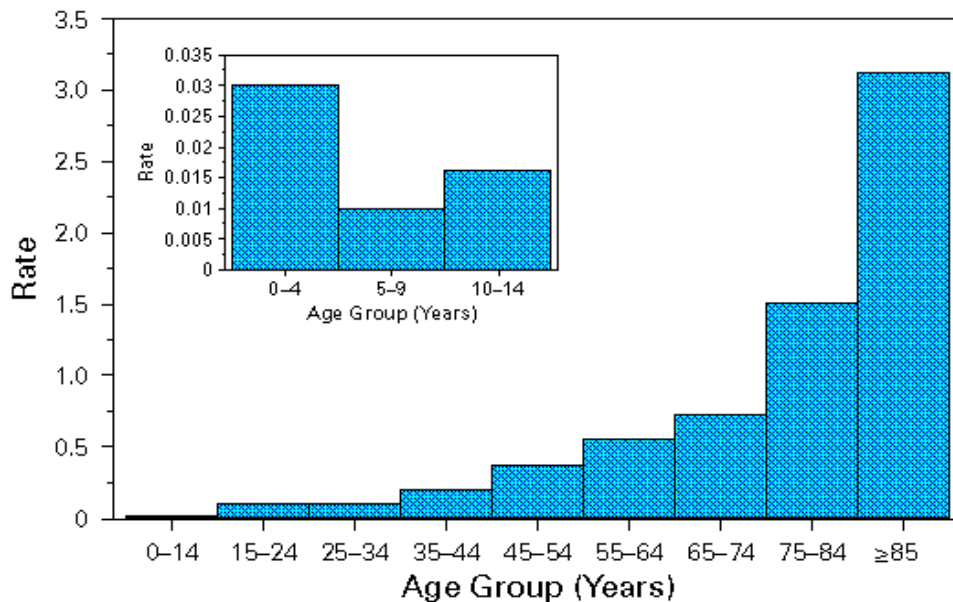
Winter storms, ice storms, and extreme cold can adversely affect people, some more than others. Those persons 65 years of age or more are especially vulnerable. See Figure 6.1A on the following page.

### ***Ice Storms***

The term ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. They can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power and communication system outages, personal injury, and death. Moreover, they can hinder the delivery of emergency services needed in response to these catastrophes and endanger the responders. Ice storms accompanied by wind gusts cause the most damage.

Ice storms result from the accumulation of freezing rain, which is rain that becomes super-cooled and freezes upon contact with cold surfaces. Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations.

The greatest threat from ice storms is to essential utility and transportation systems, also known as lifelines. It coats power and communications lines, trees, highways, bridges, and other paved surfaces. Ice-weighted wires, antennae, and structures holding them can break and collapse. Downed trees and limbs can also damage lines and block transportation routes. Both pedestrians and automobiles are at risk. Finally, extensive damage to forests can affect timber resources.



\*Per 100,000 population.

Figure 6.1A: Average Annual Rate\* of Hypothermia-Related Deaths, by age group – United States, 1979-1995

The American Lifelines Alliance (ALA) is a public-private partnership that assists in the identification of risks to lifelines and develops guidelines to improve the performance of these systems in the event of natural disasters. The ALA is funded by FEMA and managed by the National Institute of Building Science. One of the standards developed by the ALA applies to ice and wind-on-ice loads on electric power transmissions lines and communications towers. The ALA developed the map in Figure 6.1B, which indicates the expected uniform ice thickness from freezing rain with concurrent wind gust speeds for a 50-year mean recurrence period for West Virginia. Most of the state falls in a zone where the expected mean ice thickness for this period is 0.5 inch with accompanying wind gusts of 30 miles per hour.

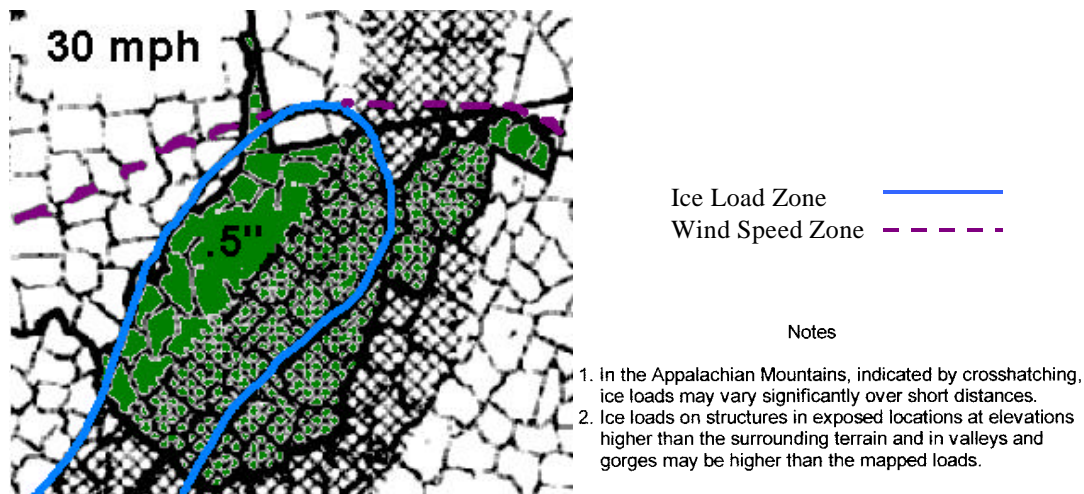


Figure 6.1B: Uniform Ice Thickness Due to Freezing Rain with Concurrent 3-second Gust Speeds for a 50-year Mean Recurrence Interval. (American Lifeline Alliance, August 2003)

For many people, Presidents' Day weekend (February 16-17, 2003) saw life come to a grinding halt as 2 to 5 inches of accumulated ice resulted in several thousand acres of timber damage, phone and power outages to many communities, and fallen trees blocking roads. The majority of the damage occurred in Mason, Jackson, Calhoun, Roane, and Braxton counties and the most common type of damage recorded was branch breakage. See Table 6.1B on the following page.

However, in a number of timber stands, trees suffered both branch breakage and snapped tops or were uprooted and lying on the ground. In parts of Mason and Jackson counties, entire conifer stands were either uprooted or bent over and lying on the ground. Hardwood species, including yellow poplar, black locust, and black cherry were particularly susceptible to limb breakage.



Ice Storm February 2003. Leslie Fitzwater, Charleston, WV

Eight deaths were blamed on the Presidents' Day storm in some way. Two people drowned while trying to cross rain-swollen creeks, two people died while shoveling snow, three people were killed in traffic accidents, and one man was killed when his trailer caught fire, after he apparently tried to heat it with either a candle or gas oven because he had no power.

## W. Va. Counties Affected by Ice Storm Presidents' Day Weekend 2003

Table 6.1B: 2003 Ice Storm Damage Assessments

#	County	Location	Damage Severity	Species Affected	Comments
1	Calhoun	Crummies Creek	Severe	Most – Esp. Red Oak	1100' elevation and up
2	Mason	Oldtown Creek	Moderate - severe	Most	Damage not uniform throughout property
3	Roane	Masters Run	Severe	All	90% uprooted or broken
4	Jackson	Cain Ridge	Moderate	Most	
5	Calhoun	Annamoriah	Severe	All – esp. oak & cherry	Combination of ice, snow, rain & sleet
6	Calhoun	Nicut Area	Severe	Most – esp. oak, cherry	Northeast slopes above 900' elev.
7	Calhoun	Near Liberty Hill	Severe	Mostly oak & poplar	Esp. bad on east side of low gaps
8	Nicholas	Near Nettie	Moderate - severe	Most – esp. poplar	
9	Kanawha	Blue Creek	Minimal	Mostly pines	Only at higher elevations
10	Jackson	Peppermint Creek	Minimal to moderate	Pine, hickory, beech	Higher value species mostly unaffected
11	Roane	Spencer Area	Severe	All	Near 100% north & east Aspects
12	Kanawha	4-Mile Coopers Ck.	Moderate - severe	All	Highest knobs, 1150' elev. & up
13	Roane/Calhoun	Boggs Fk. – Leatherbark	Severe	Primarily poplar	All northern aspects along Rt. 33
14	Cabell	Milton Area	Moderate	Mostly pines - some hardwoods	950' elevation & up
15	Roane	Island Run	Severe	All	80% of trees - N & NE aspects now gone
16	Jackson	Foster Ridge	Moderate - severe	Most – esp. pine & poplar	Devastation spotty - Mostly N & E slopes
17	Nicholas	Powell Mtn./Muddlety	Moderate - severe	Poplar, maples & oaks	Especially on eastern aspects
18	Jackson	Marshall	Severe	Small saw timber oaks	E & N slopes
19	Roane	Peniel	Mostly severe	Oaks down, poplar broken	Most damage on N & NE aspects
20	Gilmer	Rosedale	Severe	Poplar & small timber w/ grapes	Upper NE slopes
21	Braxton	Steer Creek	Moderate - severe	Most	Upper slopes on high ridges
22	Roane	Roxalana	Moderate	Mostly poplar	Only on the highest ridges
23	Roane	Gandeeville	Little to none	Poplar limbs & small tops only	Limited to N facing coves

Note: Initial indications are that trees/woodlands in at least portions of the indicated counties have experienced moderate to severe damage as a result of the ice storm. Damage may be very dramatic (90% to 100% of the trees showing visible signs of damage) in one portion of a county and virtually non-existent in another. USDA Forest Service, Morgantown West Virginia office. [<http://www.woaofwv.org/Ice%20Storm%20Map.htm>]

*From the West Virginia All Hazard Mitigation Plan, West Virginia Office of Emergency Services*